

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1. (currently amended): A method of producing a reflection-type mask blank by forming, on a substrate, at least a multilayer reflection film for reflecting exposure light and an absorber layer formed on said multilayer reflection film for absorbing the exposure light, wherein:

~~in order to avoid mixing at an interface between respective layers forming said multilayer reflection film due to thermal factors after deposition of said multilayer reflection film, heat treatment of said substrate with the multilayer reflection film is subjected to heat treatment carried out during deposition and/or after deposition of said multilayer reflection film and before a resist film is formed on said absorber layer, so as to suppress the progress of the mixing at the interface between the respective layers the heat treatment causing mixing at an interface between respective layers forming said multilayer reflection film such that decrease in peak reflectance and change in peak wavelength due to differences between peak reflectances of the multilayer reflection film before and after the heat treatment and peak wavelengths of the peak reflectances of the multilayer reflection film before and after the heat treatment do not cause mismatching with reflection mirrors of a pattern transfer apparatus using a reflection mask produced from the reflection mask blank and do not hereby cause variation in size of a pattern formed on a semiconductor substrate by use of the reflection mask.~~

2. (canceled).

3. (currently amended): A method of producing a reflection type mask blank as claimed in claim 2-1, wherein said resist film is a chemically amplified resist.

4. (currently amended): A method of producing a reflection type mask blank as claimed in claim 1, wherein a substrate heating temperature in the heat treatment is not lower than 50°C and not higher than a baking temperature of said resist film.

5. (currently amended): A method of producing a reflection type mask blank as claimed in claim 1, wherein the heat treatment is carried out by keeping said multilayer reflection film formed on said substrate in contact with a liquid held in a heated state.

6. (currently amended): A method of producing a reflection type mask, comprising ~~the a~~ step of forming a pattern ~~on~~ in said absorber layer of the reflection type mask blank produced by the method of producing a reflection type mask blank claimed in claim 1.

7. (currently amended): A method of producing a semiconductor device, comprising ~~the a~~ step of forming a fine pattern on a semiconductor substrate by lithography using said reflection type mask produced by the method of producing a reflection type mask claimed in claim 6.

8. (currently amended): A method of producing a reflection type mask blank by forming, on a substrate, at least a multilayer reflection film for reflecting exposure light and an absorber layer formed on said multilayer reflection film for absorbing the exposure light, wherein the multilayer reflection film comprises alternate layers of Mo and Si method comprising:

~~the a~~ step of carrying out, before a resist film is formed on said absorber layer, heat treatment of said multilayer reflection film formed on said substrate at a substrate heating temperature not lower than 50°C and not higher than a baking temperature of said resist film, the heat treatment being carried out for a time period equal to 3 minutes or more.

9. (currently amended): A method of producing a reflection type mask blank as claimed in claim 8, wherein said resist film is a chemically amplified resist.

10. (currently amended): A method of producing a reflection type mask blank as claimed in claim 8, wherein the heat treatment is carried out by keeping said multilayer reflection film formed on said substrate in contact with a liquid held in a heated state.

11. (currently amended): A method of producing a reflection type mask, comprising ~~the a~~ step of forming a pattern ~~on~~ in said absorber layer of the reflection type mask blank produced by the method of producing a reflection type mask blank claimed in claim 8.

12. (currently amended): A method of producing a semiconductor device, comprising the a step of forming a fine pattern on a semiconductor substrate by lithography using said reflection type mask produced by the method of producing a reflection type mask claimed in claim 11.

13. (new): A method of producing a reflection mask blank as claimed in claim 1, wherein the heat treatment is carried out after the multilayer reflection film is formed on the substrate and before other layers are formed on the substrate.

14. (new): A method of producing a reflection mask blank as claimed in claim 1, wherein a substrate heating temperature of said substrate with the multilayer reflection film in the heat treatment is not lower than 50°C and not higher than 135°C, the heat treatment being carried out for a time period equal to 3 minutes or more.

15. (new): A method of producing a reflection mask blank by forming, on a substrate, at least a multilayer reflection film for reflecting exposure light and an absorber layer formed on said multilayer reflection film for absorbing the exposure light, said method comprising:

a first measuring step of measuring a peak reflectance of the multilayer reflection film and a peak wavelength of the reflectance of the multilayer reflection film after the multilayer reflection film is formed on the substrate;

a step of carrying out a heat treatment for said substrate with the multilayer reflection film at a substrate heating temperature of said substrate with the multilayer reflection film which temperature is not lower than 50°C and not higher than a baking temperature of a resist film;

a second measuring step of measuring a peak reflectance of the multilayer reflection film and a peak wavelength of the reflectance of the multilayer reflection film after the heat treatment is carried out for said substrate with the multilayer reflection film; and

a step of checking whether change in peak wavelength and decrease in peak reflectance due to differences between the peak wavelengths and between the peak reflectances measured in the first and the second measuring steps do not cause mismatching with reflection mirrors of a pattern transfer apparatus using a reflection mask produced from the reflection mask blank and

do not thereby cause variation in size of a pattern formed on a semiconductor substrate by the use of the reflection mask.

16. (new): A method of producing a reflection mask blank as claimed in claim 15, wherein the heat treatment is carried out by keeping said multilayer reflection film formed on said substrate in contact with a liquid held in a heated state.

17. (new): A method of producing a reflection mask blank as claimed in claim 16, wherein the liquid is a cleaning liquid, the heat treatment being carried out simultaneously with cleaning using the cleaning liquid.

18. (new): A method of producing a reflection mask blank as claimed in claim 15, wherein said resist film is a chemically amplified resist formed on the multilayer reflection film.

19. (new): A method of producing a reflection mask blank as claimed in claim 15, wherein a substrate heating temperature of said substrate with the multilayer reflection film in the heat treatment is not lower than 50°C and not higher than 135°C, the heat treatment being carried out for a time period equal to 3 minutes or more.

20. (new): A method of producing a reflection mask, comprising a step of forming a pattern in said absorber layer of the reflection mask blank produced by the method of producing a reflection mask blank claimed in claim 16.

21. (new): A method of producing a semiconductor device, comprising a step of forming a fine pattern on a semiconductor substrate by lithography using said reflection mask produced by the method of producing a reflection mask claimed in claim 20.